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GENERAL SCIENCE.—*The second revised edition of the Academy's List of One Hundred Popular Books in Science.*[1] ROBERT B. SOSMAN, Chairman of the Committee on Popular Books in Science.

The "first revised edition" of the Popular Science List was published by the American Library Association in 1923 in the form of a twenty-page pamphlet, and a report on the revised list was published in this *Journal*.[2] The edition having become exhausted about two months ago, the Library Association inquired of the ACADEMY whether any revision was desired before the list was reprinted, as there seemed to be a continuing demand for such a list.[3]

The President of the ACADEMY, by a vote of the Board of Managers, thereupon appointed a special committee, consisting, as before, of the Vice-Presidents of the ACADEMY, with the writer as chairman. Since the affiliated societies, now numbering seventeen, usually make an annual change in the Vice-Presidents by whom they are represented, the appointment of this group as the active Committee automatically insures not only a broad representation of the branches of science, but also a personnel different from that of previous Committees.

For general comments on the character of the list, and a history of its original compilation, reference may be made to the last report.[4]

The new Committee has met, and has approved the following changes.

[1] Received July 13, 1925.
[2] This JOURNAL **12**: 469–476. December 19, 1922.
[3] See news item in This JOURNAL **15**: 206. May 4, 1925.
[4] *Op. cit.* 1922.

ADDITIONS

SLOSSON, E. E. *Keeping up with science.* New York, Harcourt, Brace & Co., 1924. 355 pp., 30 pls.

WISSLER, CLARK. *Man and culture.* New York, Crowell Co., 1923. 371 pp.

HADDON, A. C. *The races of Man and their distribution.* New York, Macmillan Co., 1925. 201 pp., 10 pls. This work was included in the Preliminary Edition of 1921, but was removed in 1922 because it was then out of print. A new edition is now available.

HUMPHREYS, W. J. *Weather proverbs and paradoxes.* Baltimore, Williams & Wilkins Co., 1923. 125 pp., 16 pls.

BROOKS, CHARLES F. *Why the weather?* New York, Harcourt, Brace & Co., 1924. 310 pp., 26 pls.

TALMAN, CHARLES F. *Our weather, what makes it and how to watch it.* New York, Reynolds Publ. Co., 1925. 384 pp., 21 pls.

BALL, W. W. ROUSE. *Mathematical recreations and problems.* Tenth Ed. London, Macmillan & Co., 1922. 508 pp.

The Committee would have liked to include F. ROTH: *First book of forestry* (Boston, Ginn & Co., 1902) among the botanical books, but finds it to be out of print.

REMOVALS

To keep the list at exactly one hundred, the following have been removed for the reasons indicated:

THOMSON, J. ARTHUR, Editor. *The outline of science.* The principal objection to this work is its bulk. It was originally published in England in two large volumes, and has been republished in the United States as four volumes, too large a work to carry home conveniently from a library.

MASON, O. T. *Woman's share in primitive culture.* Not so well adapted to the purpose of the list as the author's *Origins of invention*, which remains on the list; goes too much into descriptive detail.

MCCOLLUM, E. V. *The newer knowledge of nutrition.* This work has been considerably enlarged in its later editions, and is believed to contain far too much detailed evidence for a book suited to popular reading, although it is indispensable to the specialist.

MORGAN, T. H. *A critique of the theory of evolution.* Written for students of college rank as regards preparation in biological sciences, and is too specialized for this list.

CHAMBERLIN, T. C. *Origin of the Earth.* This book contains much material that is still the subject of controversy among geologists and cosmogonists. Although a stimulating book, it might give to a reader approaching the subject for the first time a misleading impression of geology as a highly speculative science.

GEIKIE, ARCHIBALD. *The founders of geology.* As stated in the last report, this book was put on the list as a temporary extra item, awaiting a new edition of MERRILL'S *First hundred years of American geology,* which was then in press and is now available.

LEMPFERT, R. G. K. *Weather science.* This book was written primarily for British readers, and being devoted mainly to weather forecasting, has little reference to conditions in the United States. Meteorology and the weather provide such unusually suitable material for popular science that the Preliminary List contained several books touching these subjects, but all except one were rendered ineligible for the First Revised List through being out of print. This gap has recently been filled by three excellent books, those by Humphreys, Brooks, and Talman.

SHAW, JAMES BYRNIE. *Lectures on the philosophy of mathematics.* This work requires too extended a knowledge of mathematics to serve the purposes of this list.

REARRANGEMENTS

The order of arrangement and the grouping of the books have been altered somewhat, but will still be found unsatisfactory by many readers. When we consider the numerous and complex ramifications of science it is not surprising that a logical linear classification of one hundred titles is difficult to achieve.

The complete list, as published by the American Library Association, contains a descriptive paragraph about each book, with connecting paragraphs joining the groups of books, in order that even the reader who does nothing more than glance through the list may gain some feeling of the unity of scientific knowledge and the interrelations of its branches. These paragraphs need not be reprinted here, but the complete list of authors and titles is given below for reference.

A GENERAL VIEW:

1. HUXLEY, THOMAS HENRY. *Selections from Huxley.*
2. SLOSSON, EDWIN E. *Keeping up with science.*
3. CURTIS, WINTERTON C. *Science and human affairs.*

SCIENCES OF MAN:

Psychology:

4. THORNDIKE, EDWARD L. *The Human Nature Club.*
5. JAMES, WILLIAM. *Psychology.*
6. WOODWORTH, ROBERT S. *Psychology; a study of mental life.*

Anthropology:

7. OSBORN, HENRY FAIRFIELD. *Men of the Old Stone Age.*
8. WISSLER, CLARK. *Man and culture.*

9. MASON, O. T. *The origins of invention.*
10. HADDON, A. C. *The races of Man and their distribution.*
11. HOUGH, WALTER. *The Hopi Indians.*

Human physiology:

12. SHERMAN, H. C. *Food products.*
13. EDDY, WALTER H. *The vitamine manual.*
14. JORDAN, E. O. *Food poisoning.*
15. KEEN, WILLIAM WILLIAMS. *Medical research and human welfare.*
16. HUNTINGTON, ELLSWORTH. *Civilization and climate.*

SCIENCES OF LIFE:

Heredity:

17. DARWIN, CHARLES. *The origin of species.*
18. EAST, E. M., and JONES, D. F. *Inbreeding and outbreeding.*
19. CASTLE, W. E., COULTER, J. M., DAVENPORT, C. B., EAST, E. M., and TOWER, W. L. *Heredity and eugenics.*
20. CONKLIN, E. G. *Heredity and environment.*
21. GALTON, FRANCIS. *Hereditary genius.*
22. POPENOE, PAUL, and JOHNSON, R. H. *Applied eugenics.*

General biology:

23. THOMSON, J. ARTHUR. *The wonder of life.*
24. THOMSON, J. ARTHUR. *The haunts of life.*
25. LOCY, WILLIAM A. *Biology and its makers.*

Zoology:

26. BUCKLEY, A. B. *The winners in life's race.*
27. NELSON, E. W. *Wild animals of North America.*
28. ROOSEVELT, THEODORE. *African game trails.*
29. BEEBE, C. W. *Jungle peace.*
30. STONE, WITMER, and CRAM, W. E. *American animals.*
31. CHAPMAN, FRANK M. *Camps and cruises of an ornithologist.*
32. FABRE, J. H. *Social life in the insect world.*
33. BOUVIER, E. L. *The psychic life of insects.*
34. MAETERLINCK, MAURICE. *The life of the bee.*
35. JENKINS, OLIVER P. *Interesting neighbors.*
36. BLATCHLEY, W. S. *Gleanings from nature.*
37. MAYER, ALFRED G. *Sea-shore life.*

Botany:

38. GANONG, W. F. *The living plant; a description and interpretation of its functions and structure.*
39. OSTERHOUT, W. J. V. *Experiments with plants.*
40. SORAUER, PAUL. *A popular treatise on the physiology of plants.*
41. HARDY, MARCEL E. *The geography of plants.*
42. DARWIN, CHARLES. *Insectivorous plants.*
43. TOWNSEND, C. W. *Sand dunes and salt marshes.*

Microscopic life:

44. VALERY-RADOT, RENÉ. *Louis Pasteur, his life and labours.*

Ancient life:

45. LUCAS, F. A. *Animals of the past.*

46. HUTCHINSON, H. N. *Extinct monsters and creatures of other days.*

SCIENCES OF THE EARTH:

47. GREGORY, J. W. *Geology of to-day.*

48. HAWKSWORTH, HALLAM. *The strange adventures of a pebble.*

49. LULL, R. S., and others. *The evolution of the Earth and its inhabitants.*

50. COLE, GRENVILLE A. J. *Rocks and their origins.*

51. MERRILL, GEORGE P. *The first one hundred years of American geology.*

52. SEMPLE, ELLEN CHURCHILL. *Influences of geographic environment.*

53. SPURR, J. E., *Ed. Political and commercial geology and the world's mineral resources.*

54. BRIGHAM, ALBERT P. *Geographic influences in American history.*

The Earth's surface:

55. TYNDALL, JOHN. *The forms of water in clouds and rivers, ice and glaciers.*

56. BONNEY, T. G. *The work of rains and rivers.*

57. BONNEY, T. G. *Volcanoes, their structure and significance.*

58. RUSSELL, ISRAEL C. *Volcanoes of North America.*

59. DAVISON, CHARLES. *The origin of earthquakes.*

The air and the ocean:

60. HUMPHREYS, W. J. *Weather proverbs and paradoxes.*

61. BROOKS, CHARLES F. *Why the weather?*

62. TALMAN, C. F. *Our weather; what makes it and how to watch it.*

63. WARD, R. DE C. *Climate, considered especially in relation to Man.*

64. MURRAY, JOHN. *The ocean.*

SCIENCES OF THE HEAVENS:

65. BALL, ROBERT S. *The story of the heavens.*

66. DYSON, F. W. *Astronomy.*

67. HALE, GEORGE E. *The new heavens.*

68. ABBOT, CHARLES G. *The Sun.*

69. LEWIS, ISABEL M. *Splendors of the sky.*

70. MURPHY, E. G. *A beginner's star book;* by Kelvin McKready, *pseud.*

71. TURNER, H. H. *A voyage through space.*

72. BERRY, ARTHUR. *A short history of astronomy.*

SCIENCES OF THINGS AND EVENTS:

Chemistry:

73. SLOSSON, E. E. *Creative chemistry.*

74. HENDRICK, ELLWOOD. *Everyman's chemistry.*
75. FULLER, HENRY C. *The story of drugs.*
76. FABRE, JEAN HENRI. *The wonder book of chemistry.*
77. DUNCAN, ROBERT KENNEDY. *The chemistry of commerce.*
78. MARTIN, GEOFFREY. *Modern chemistry and its wonders.*
79. SODDY, FREDERICK. *The interpretation of radium.*
80. VENABLE, F. P. *A short history of chemistry.*
81. SMITH, EDGAR FAHS. *Chemistry in America.*

Physics:

82. SODDY, FREDERICK. *Matter and energy.*
83. MILLS, JOHN. *Within the atom.*
84. EINSTEIN, ALBERT. *Relativity.*
85. FLEMING, J. A. *Waves and ripples in water, air and aether.*
86. MILLER, DAYTON C. *The science of musical sounds.*
87. BRAGG, WILLIAM. *The world of sound.*
88. LUCKIESH, M. *Color and its applications.*
89. BOYS, C. V. *Soap bubbles; their colours and the forces which mould them.*
90. MACH, ERNST. *Popular scientific lectures.*
91. SODDY, FREDERICK. *Science and life.*

SCIENCES OF FORM AND RELATION:

92. BALL, W. W. ROUSE. *Mathematical recreations and problems.*
93. WHITEHEAD, A. N. *Introduction to mathematics.*
94. CONANT, LEVI LEONARD. *The number concept, its origin and development.*
95. YOUNG, JOHN WESLEY. *Lectures on the fundamental concepts of algebra and geometry.*
96. DE MORGAN, AUGUSTUS. *On the study and difficulties of mathematics.*
97. SMITH, DAVID EUGENE. *Number stories of long ago.*

HISTORY OF SCIENCE:

98. LIBBY, WALTER. *An introduction to the history of science.*
99. SEDGWICK, W. T., and TYLER, H. W. *A short history of science.*
100. WHITE, ANDREW D. *A history of the warfare of science with theology in Christendom.*

GEOPHYSICS.—*On some of the greater problems of physical geology.*[1] CLARENCE E. DUTTON.

The greatest problems of physical geology I esteem to be: 1st, What is the potential cause of volcanic action? 2d, What is the cause of the elevation and subsidence of restricted areas of the earth's surface? 3d, What is the cause of the foldings, distortions, and fractures of the strata?

The volcanic problem is at present unsolved. Every theory or hypothesis thus far offered to explain it goes to pieces at the touch of criticism. For elevations and subsidences we are also without any satisfactory explanation. But the third problem, the cause of distortions and fractures in the strata, looks much more hopeful, and it is my intention to propose this evening a solution of it, not a new one, let me say, but an old one remodeled. Before proceeding to discuss it, it is proper to advert to a hypothesis which has long been in favor, and which is looked upon by some authorities as affording an explanation. This is sometimes called the contractional hypothesis.

The earth is regarded as being hot within and undergoing secular cooling by conduction of heat through its external shell and its radiation into space. This loss of interior heat is presumed to be accompanied by a corresponding loss of interior volume, thus depriving the cold exterior shell of a part of its support. In a body so large as the earth the tangential strain set up by this loss of interior support is demonstrably so great that the outer shell or crust, as it is usually called, must be crushed or buckled by it and collapse upon the shrinking nucleus. The objection to this explanation is twofold: In the first place, we cannot, without resorting to violent assumptions, find in this process a sufficient amount of either linear or volume contraction to account for the effects attributed to it. In the second place, the distortions of the strata are not of the kind which could be produced by such a process. As regards the first objection I will confine myself here to a mere reference to the very able analysis of the problem by Rev. Osmond Fisher. I see no satisfactory reply to his argument. As regards the second objection, which, if possible, is more cogent still, it may be remarked that the most striking

[1] An address read before the Philosophical Society of Washington, April 27, 1889. and published in the Bulletin, 11: 51–64. 1889. It is reprinted here on the recommendation of the General Committee of the Philosophical Society of Washington, because it is the earliest summary of the theory of isostasy which is receiving widespread attention and the original source is readily accessible to few persons.

features in the facts to be explained are the long, narrow tracts occupied by belts of plicated strata and the approximate parallelism of the axes of their folds. These call for the action of some great horizontal force thrusting in one direction. Take, for example, the Appalachian system, stretching from Maine to Georgia. Here is a great belt of parallel synclinals and anticlinals with a persistent trend, and no rational inquirer can doubt that they have been puckered up by some vast force acting horizontally in a northwest and southeast direction. Doubtless it is the most wonderful example of systematic plication in the world. But there are many others which indicate the operation of the same forces with the same broad characteristics. The particular characteristic with which we are here concerned is that in each of these folded belts the horizontal force has acted wholly or almost wholly in one direction. But the forces which would arise from a collapsing crust would act in every direction equally. There would be no determinate direction. In short, the process could not form long, narrow belts of parallel folds. As I have no time to discuss the hypothesis further I dismiss it with the remark that it is quantitatively insufficient and qualitatively inapplicable. It is an explanation which explains nothing which we want to explain.

In proposing another view of the problem we may first turn our attention to those obvious and universally conceded forces which determine the figure of the earth. That figure we know to be one which a liquid or viscous body of large size will take when subject only to the forces arising from rotation around an axis and to the mutual gravitation of its own parts. This form is an oblate spheroid.

The spherical form, however, is only approximate. We find large portions of its surface protruding into continents and islands, while others are sunken to form oceanic basins. How did these inequalities arise? If the form of the earth is nearly spheroidal why is it not exactly so? It has always been supposed that this nearly spheroidal form implies that the earth, if not liquid, is certainly not rigid enough to maintain any other form against the forces of its own gravitation. Even if the earth were a mass of unbroken steel no great departure from this shape could be maintained for a moment. It would straightway collapse and flow into a spheroidal form. But if gravitation compels it to take a nearly spheroidal shape why should it stop short of making it perfectly so? Perhaps it will be said that while the rigidity of rocks may be insufficient to permit a great deformation of the normal spheroid it may be sufficient to permit a small one.

Before discussing this point it will be necessary to introduce a consideration which has seldom been touched upon by geographers or geologists.

If the earth were composed of homogeneous matter its normal figure of equilibrium without strain would be a true spheroid of revolution; but if heterogeneous, if some parts were denser or lighter than others, its normal figure would no longer be spheroidal. Where the lighter matter was accumulated there would be a tendency to bulge, and where the denser matter existed there would be a tendency to flatten or depress the surface. For this condition of equilibrium of figure, to which gravitation tends to reduce a planetary body, irrespective of whether it be homogeneous or not, I propose the name *isostasy*. I would have preferred the word isobary, but it is preoccupied. We may also use the corresponding adjective, isostatic. An isostatic earth, composed of homogeneous matter and without rotation, would be truly spherical. If slowly rotating, it would be a spheroid of two axes. If rotating rapidly within a certain limit, it might be a spheroid of three axes.

But if the earth be not homogeneous—if some portions near the surface be lighter than others—then the isostatic figure is no longer a sphere or spheroid of revolution, but a deformed figure bulged where the matter is light and depressed where it is heavy. The question which I propose is: How nearly does the earth's figure approach to isostasy?

Mathematical statics alone will not enable us to answer this question with a sufficient degree of approximation. It does, indeed, enable us to fix certain limits to the departure from isostasy which cannot be exceeded. This very problem has been treated with great skill by Prof. George Darwin.

But this problem may be approached from another direction with more satisfactory results. Geology furnishes us with certain facts which enable us to draw a much narrower conclusion. There are several categories of fact to which we may turn. One of the most remarkable is the general fact that where great bodies of strata are deposited they progressively settle down or sink seemingly by reason of their gross mechanical weight, just as a railway embankment across a bog sinks into it. The attention of the earlier Appalachian geologists was called, as soon as they had acquired a fair knowledge of their field, to the surprising fact that the paleozoic strata in that wonderful belt, though tens of thousands of feet in thickness, were all deposited in comparatively shallow water. The

paleozoic beds of the Appalachian region have a thickness ranging from 15,000 to over 30,000 feet, yet they abound in proofs that when they were deposited their surfaces were the bottom of a shallow sea whose depth could not probably have exceeded a few hundred feet. No conclusion is left us but that sinking went on pari passu with the accumulation of the strata. When the geology of the Pacific coast was sufficiently disclosed, the same fact confronted us there. As investigation went on the same fact presented itself over the western mountain region of the United States. One of the most striking cases is the Plateau Country. This great region, nearly 100,000 square miles in area, lying in the adjacent parts of Colorado, Utah, New Mexico, and Arizona, discloses from 8000 to 12,000 feet of mesozoic and cenozoic strata. Here the proof is abundant that the surface of the strata was throughout that vast stretch of time never more than a few feet from sea level. Again and again is emerged from the water a little way, only to be submerged. At many horizons grew forests which are now represented by those abundant and beautiful fossil woods which of late have become celebrated. In the cretaceous we find many seams and seamlets of coal or carbonaceous shale; but they are included between sandstones which are cross-bedded and ripple-marked, or between shales and limestones which abound in the remains of marine mollusca. Here the evidence seems conclusive that the whole subsidence went on at about the same rate as the surface was built up by deposition. In short, it may be laid down as a general rule that where great bodies of sediment have been deposited over extensive areas their deposition has been accompanied by a subsidence of the whole mass.

The second class of facts is even more instructive, and stands in a reciprocal relation to those just mentioned. Wherever broad mountain platforms occur and have been subjected to great erosion the loss of altitude by degradation is made good by a rise of the platform. In the western portion of the United States there occur mountain ranges situated upon broad and lofty platforms from 20 to 60 miles wide and from 50 to 200 miles in length. Some of these platforms contain several mountain ridges. All of them have been enormously eroded, and if the matter removed from them could be replaced it would suffice to build them to heights of eight or ten miles; yet it is incredible that these mountains were ever much loftier than now, and may never have been so lofty. The flanks of these platforms, with the upturned edges of the strata reposing against them or with gigantic faults measuring their immense uplifts, plainly declare to

us that they have been slowly pushed upwards as fast as they were degraded by secular erosion.

It seems little doubtful that these subsidences of accumulation deposits and these progressive upward movements of eroded mountain platforms are, in the main, results of gravitation restoring the isostasy which has been disturbed by denudation on the one hand and by sedimentation on the other. The magnitudes of the masses which thus show the isostatic tendency are in some cases no greater than a single mountain platform, less than 100 miles in length, from 20 to 40 miles wide and from 2500 to 3500 feet mean altitude above the surrounding lowlands. From this we may directly infer that in those regions the effective rigidity of the earth is insufficient to uphold a mass so great as one of those platforms if that mass constituted a real deformation of isostasy; and if an equal mass were to be suddenly removed the earth would flow upward from below to fill the hiatus; hence we must look to considerably smaller masses to find a defect of isostasy. It is extremely probable that small or narrow ridges are not isostatic with respect to the country round about them. Some volcanic mountains may be expected to be non-isostatic, especially isolated volcanic piles.

Thus the geologic changes which have taken place may be regarded as experiments conducted by Nature herself on a vast scale, and from her experiments we may by suitable working hypotheses draw provisional conclusions, both as to the degree in which the earth approximates to isostasy and also as to the mean effective rigidity of large portions of the subterranean mass. The approach to isostasy is thereby inferred to be very near, while the mean rigidity of the subterranean masses is also inferred to be far less than that of ordinary surface rocks, and even approaching more nearly the rigidity of lead than to that of copper. Pure physics alone would not have enabled us to reach such a conclusion, for the equations employ constants of unknown value. But geologic inquiry may, and I believe does, furnish us with narrow limits within which those values must be taken. Thus the two sciences must work coöperatively and supplement each other.

There is, however, one other branch of physical inquiry which bears directly on the foregoing questions. This is the investigation of terrestrial gravitation by means of the pendulum. I regret that I have never had time or opportunity to acquaint myself thoroughly with the results thus far reached by this branch of investigation, and can only speak from general knowledge. Pendulum observations

are far too few for the wants of geographic or geologic science. So far as they go they are highly suggestive in the present connection. The pendulum, as a rule, does not show any appreciable variation of gravity, such as would be expected if the mean density of all the outer parts of the earth were uniform. It indicates rather that the elevated regions and continents are composed of lighter matter and the depressed regions and ocean basins of denser matter. The exceptions are of a character which prove the general rule, and occur where we should look for them. The results obtained by the India survey upon the Himalayan mass were regarded by Archdeacon Pratt as indicating that the plateau was composed of lighter matter than the lowlands to the southward. A similar result has been obtained in the great bulge which forms the western half of the United States. In other words, the pendulum indicates that those elevated regions are nearly if not quite isostatic.

On the other hand, the observations of Mendenhall on Fujiyama, in Japan, indicated a slight excess of mass, and a similar result would seem to follow from Mr. Preston's work in the Hawaiian Islands. From the nature of the process by which volcanoes are built these results are to be expected.

It would also seem natural to expect that the plumb-line would give some indications upon this subject; but experience has shown that most of the observed deflections of the plumb-line are inexplicable. They occur where we would least expect them—upon broad and level plains, where there is nothing to indicate any cause of deflection. They are found on the tundras of Siberia and the monotonous expanse of British North America, where the surface of the earth is but feebly diversified. In mountain regions they are often conflicting and unintelligible, but along the sea coast the indications are more systematic. On both the Atlantic and Pacific shores the deflection of the plummet is almost invariably towards the ocean, and is often of considerable amount; but it is along the shore that the isostatic theory would lead us to look for just this deflection, for it is along the margins of the continents that great bodies of sediment accumulate; and so long as the earth possesses any noteworthy degree of rigidity, enabling it to sustain in part the resulting deformation of isostasy, so long must we expect to find these sediments constituting an excess of mass whose attraction will make itself felt upon the plummet.

The theory of isostasy thus briefly sketched out is essentially the theory of Babbage and Herschel, propounded nearly a century ago.

It is, however, presented in a modified form, in a new dress, and in greater detail. We may now proceed to deduce some important consequences.

A little reflection must satisfy us that the secular erosion of the land and the deposit of sediment along the shore lines constitute a continuous disturbance of isostasy. The land is ever impoverished of material—is continuously unloaded; the littoral is as continuously loaded up. The resultant forces of gravitation tend to elevate the eroded land and to depress the littoral to their respective isostatic levels. Whether these forces shall become kinetic and produce actual movement or flow will depend, first, upon their intensity; second, upon the rigidity of the earth by which such movement is resisted. Let us consider, then, the intensity of the forces.

The littoral belts upon which sediments are thrown down are coextensive in length with shores. Their widths are no doubt variable, but must often reach a hundred miles or more with considerable thickness, and are not wholly unimportant at much greater distances. The thickness of the deposits may vary much, but may be proportional to the time of accumulation, and here time is measured by the geologic standard. The gross weight of such masses of sediment must be vast indeed. If there is any viscous yielding at all the problem becomes essentially that of the flowing solid, which is in a large measure governed by hydrostatic laws. The intensity of the force must have a maximum value proportional to the thickness which lies above the isostatic level and also proportional to its specific gravity. The area covered by the deposit enters as a quantity factor, but not as an intensity factor. The greater the area, the greater is the total potential energy of movement without any necessary increase of the intensity of the force. This intensity, being proportional to the thickness of the sediments, may become almost indefinitely great or it may be small. Indeed, it may, and in fact does, become negative when we apply the same statical theory to the movement or stress of the denuded land areas.

But whether these forces are sufficient to produce actual flow is equally dependent upon the rigidity, or, as we may here term it, the viscosity of the masses involved. We have already seen reason to infer that the mean viscosity is not great, being far less than that on the surface rocks alone. Beyond this rather vague statement I perceive no way of assigning a value to the resistance to be overcome.

It remains to inquire what is the resulting direction of motion.

The general answer is, towards the direction of least resistance. The specific answer, which must express the direction of least resistance, will, of course, turn upon the configuration of the deposition on the one hand, and of denudation on the other, and also upon the maner in which the rigidity or viscosity varies from place to place. Taking, then, the case of a land area undergoing denudation, its detritus carried to the sea and deposited in a heavy littoral belt, we may regard the weight of each elementary part of the deposited mass as a statical force acting upon a viscous support below. Assuming that we could find a differential expression applicable to each and every element of the mass and a corresponding one for the resistance offered by the viscosity, the integration for the entire mass might give us a series of equipotential surfaces within the mass. The resultant force at any point of any equipotential surface would be normal to that surface. A similar construction may be applied to the adjoining denuded area, in which the defect of isostasy may be treated as so much mass with a negative algebraic sign. The resultants normal to the equipotential surfaces would, in this case, also have the negative sign. The effective force tending to produce movement would be the arithmetical sum of the normals or of a single resultant compounded of the two normals. From this construction we may derive a force which tends to push the loaded sea bottoms inward upon the unloaded land horizontally.

This gives us a force of the precise kind that is wanted to explain the origin of systematic plications. Long reflection and considerable analysis have satisfied me that it is sufficient both in intensity and in amount unless we assume for the mean viscosity of the superficial and subterranean masses involved in the movement a much greater value than I am disposed to concede. The result is a true viscous flow of the loaded littoral inward upon the unloaded continent.

There may be in this proposition some degree of violence to a certain mental prejudice against the idea that the rock-ribbed earth, to which all our notions of stability and immovableness are attached, can be made to flow. It may assist our efforts if we reflect upon the motion of the great ice sheet which covers Greenland. Here the masses involved are no greater than some masses of sediment. The specific gravity of ice is only about one-third that of the rock masses. The forces called into play to carry the glacier along horizontally do not seem to differ greatly in intensity or amount from the described forces, and the rigidity of the ice itself may not exceed the mean rigidity of the rock masses beneath the littoral.

We may now proceed to inquire how this theory adjusts itself to the actual facts. And, firstly, where do systematic plications occur?

(1) It is a remarkable fact that they occur among sedimentary beds of great and variable thickness, which were rather rapidly accumulated. They seldom, and, so far as I now recall, never occur among strata which are of small thickness, slowly accumulated with uniformity over large areas; and the theory requires that they should occur in the heavy deposits or along their margins, and should have their greatest development there, for the forces called into play must be proportional to the masses involved.

(2) They occur in their systematic form along the ancient shore lines. This is but another way of stating the preceding proposition. It has its uses, however, for in so far as the continents have preserved approximately their old shore lines since the ages in which the plications were formed there is a conspicuous parallelism of the axes of plication to the neighboring coast. This is true of the Pacific coast of the United States. As regards the Appalachian plications, we have the remarkable fact that in paleozoic time the ocean lay to the west of those vast bodies of folded strata instead of to the east of them, as now. We must look to a paleozoic Atlantis for the origin of a great portion of those sediments. The flow of the earth was from west northwest to east southeast.

(3) The parallelism of the folds and their occurrence in long, narrow belts formed by horizontal forces acting in one direction become a consequence so obvious as to need no comment. It is in strong contrast with the contractional theory, which gives a force without any determinate direction.

(4) Another important fact is that these systematic flexures were mainly formed at the times the sediments were deposited. This is a fact of geologic observation. The contractional hypothesis gives no determinate time for the formation of these flexures. It holds up to us a process continuous through all geological time, proceeding at a rate which diminishes but slowly as the ages roll by. These plications, according to the isostatic theory, are the results of the disturbance of isostasy, and follow immediately upon that disturbance or after it has reached a sufficient amount, and cease with it. These folds, however, have been subject since their first formation to great erosion, which is also a disturbance of isostasy, and thus the original plication may have been increased or modified thereby.

The theory may also be applied in a most satisfactory manner to the explanation of subordinate features associated with plication.

(5) One of the features of plication which has attracted great attention and occasioned great perplexity to geologists is the so-called fan-structure. This is very striking in the Alps, and has its counterpart in the inclined folds of the Appalachians of Pennsylvania, where the northwestern branches of the anticlines are steeper than the southeastern branches. If we assume that as the rocks lie deeper in the earth they are softened somewhat by the increasing heat, it follows that in the flow of the mass the movement would be easier and more rapid below than above. Thus a horizontal force arising from this differential movement acts upon the inverted arches of the synclines and carries their lower vertices forward in the direction of motion.

Thus the general theory here proposed gives an explanation of the origin of plications. It gives us a force acting in the direction required in the manner required, at the times and places required, and one which has the intensity and amount required and no more. The contractional theory gives us a force having neither direction nor determinate mode of action, nor definite epoch of action. It gives us a force acting with a far greater intensity than we require, but with far less quantity. To provide a place for its action it must have recourse to an arbitrary postulate assuming for no independent reason the existence of areas of weakness in a supposed crust which would have no raison d'etre except that they are necessary for the salvation of the hypothesis.

Before closing this discussion it will be necessary to advert to another one of the great problems of physical geology, viz., the cause of general elevations and subsidences. I do so, not with the idea of throwing light upon it, but to guard against a misapprehension which would otherwise be sure to occur.

Geologic history discloses the fact that some great areas of the earth's surface which were in former ages below sea-level are now thousands of feet above it. It also gives us reason to believe that other areas now submerged were in other ages terra firma. Our western mountain region at the beginning of cenozoic time was at sea level. It is now, on an average, 6000 feet above it. The great Himalayan plateau contains early cenozoic beds full of marine fossils which now lie at altitudes of 14,000 feet or more. The whole North American Continent has, since the close of the paleozoic, gained in altitude. Now, it is sufficiently obvious that the theory of isostasy offers no explanation of these permanent changes of level. On the contrary, the very idea of isostasy means the conservation of pro-

files against lowering by denudation on the land and by deposition on the sea bottom, provided no other cause intervenes to change those levels. If, then, that theory be true, we must look for some independent principle of causation which can gradually and permanently change the profiles of the land and sea bottom. And I hold this cause to be an independent one. It has been much the habit for geologists to attempt to explain the progressive elevation of plateaus and mountain platforms, and also the foldings of the strata by one and the same process. I hold the two processes to be distinct and having no necessary relation to each other. There are plicated regions which are little or not at all elevated, and there are elevated regions which are not plicated. Plication may go on with little or no elevation in one geologic age and the same region may be elevated without much additional plication in a subsequent age. This is in a large measure true of the Sierra Nevada platform, which was intensely plicated during the paleozoic and early mesozoic, but which received its present altitude in the late cenozoic.

Whatever may have been the cause of these great regional uplifts it in no manner affects the law of isostasy. What the real nature of the uplifting force may be is, to my mind, an entire mystery; but I think we may discern at least one of its attributes, and that is a gradual expansion, or a diminution of the density, of the subterranean magmas. If the isostatic force is operative at all, this expansion is a rigorous consequence; for whenever a rise of the land has taken place one of two things has happened; the region affected has either gained an accession of mass or a mere increase of volume without increase of mass. We know of no cause which could either add to the mass or diminish the density, yet one of the two must surely have happened. But the difference of the two alternatives in respect to consequences is immense. If the increase of volume of an elevated area be due to an accession of matter, the plateau must be hoisted against its own ri idity and also against the statical weight of its entire mass lying above the isostatic level. But if the increase of volume be due to a decrease of density there is no resistance to be overcome in order to raise the surface. Hence I infer that the cause which elevates the land involves an expansion of the underlying magmas, and the cause which depresses it is a shrinkage of the magmas. The nature of the process is, at present, a complete mystery.

BOTANY.—*A new acid-soil onion from West Virginia.* EDGAR T. WHERRY, Bureau of Chemistry.

The widespread Nodding Onion, *Allium cernuum* Roth, grows on limestone ledges, in alluvial soil, and in other situations where the soil is circumneutral in reaction. In the course of the writer's studies of the relations between soil reaction and the distribution of native plants, a relative of that species was found to occur in southeastern West Virginia and adjoining Virginia, where the soil reaction is often decidedly acid. In the usual keys this runs down to *A. cernuum*, but close examination indicates it to be sufficiently different to justify its recognition as a distinct species. In view of its preference for acid soil habitats, it may be named *Allium oxyphilum*. Its features are as follows:

Allium oxyphilum sp. nov.

Plants occurring in scattered small colonies on rocky or gravelly slopes over shale and sandstone, and in residual clay over limestone, the soil reaction being more or less strongly acid. Bulb slender, tapering gradually upward; coatings membranous, outermost gray, inner white to dull reddish (Ridgway purplish vinaceous, 1‴b). Leaves basal, 10–25 cm. long, 2–7 mm. wide, flat toward the tip, keeled and crescentic in cross-section toward the base. Scape 25–45 cm. long, 1–3 mm. thick, in cross section rhombic with the acute angles prolonged, thus appearing two-edged. Umbel nodding in anthesis, becoming erect in fruit, of 10 to 40 flowers, subtended by two scarious bracts formed by the splitting of the spathe which surrounds the buds. Pedicels slender and flexuous, 2–4 cm. long. Flowers campanulate, green at the base of the sepals, otherwise pure white or exceptionally pale pink. Perianth segments oblong-ovate, obtuse, concave and somewhat keeled, of two sorts, the sepals 4–5 mm. long, spreading, the petals 5–6 mm. long, connivent. Stamens in two groups, those opposite the petals elongating and maturing a day or two earlier than those opposite the sepals. Capsule at maturity triangular-top-shaped, about 4 mm. high and 5 mm. broad; the 6 narrowly deltoid crests grouped in pairs, and the members of each pair lying practically in the same plane; crests 1.5–3 mm. long, slightly erose, granular-margined. Blooming period from mid-July to late August.

As the type locality may be designated open woods along the road 2 km. (1¼ miles) westnorthwest of Lillydale, Springfield Township, Monroe County, West Virginia (Alderson quadrangle, U. S. G. S.). Type specimens collected there by Messrs. W. A. Benfield, F. W. Gray and the writer August 12, 1924, have been deposited in the U. S. National Herbarium. The rock there is limestone, but it is covered with dense residual clay of minimacid reaction. The plant has been observed growing at a number of other places in the Appalachian Valley and Appalachian Plateau provinces in southwestern Virginia and southeastern West Virginia, but so far as known is endemic in an area not more than 100 km. (60 miles) in diameter. It is particularly abundant in subacid to mediacid soil in open woods on shale rock, growing in association with other endemics such as *Trifolium virginicum* Small and *Pseudotaenidia montana* Mackenzie. It has been found to grow well in cultivation, and should make a desirable addition to any rock

garden. When planted in neutral soil it produces few viable seeds, and so does not spread as rapidly as do some species of *Allium*. It may be assigned the common name of Acid-soil Onion.

The most striking differences between this new species and *A. cernuum*, evident in field and herbarium alike, lie in the flower color and the length of the pedicels. In addition, the race of *A. cernuum* which grows in the same general region has the petals and sepals less differentiated, the stamens maturing more nearly together, and the crests on the capsule shorter, more broadly deltoid, and with more markedly erose and notched margins, while the

Fig. 1.—*Allium oxyphilum*, sp. nov. Lillydale, West Virginia

members of the pairs lie at considerable angles with one another instead of being essentially coplanar. It also blooms two to three weeks earlier than *A. oxyphilum*, all of these divergences remaining constant when the two are cultivated side by side. Fresh material of western races of *A. cernuum* or of *A. allegheniense* Small have not been available for comparison; descriptions and herbarium specimens indicate that they may approach the new species in having distinct sepals and petals, but not in the other respects enumerated.

In order to complete the characterization of *Allium oxyphilum* as a distinct species, two photographs of it by the writer are here reproduced.

The first (Fig. 1), taken at the type locality, brings out the general aspect of the plant, which is sufficiently different from that of *A. cernuum* to enable the two to be distinguished at a distance, or from a moving vehicle; the prominent divided leaves in the background are those of *Delphinium exaltatum*

Fig. 2.—*Allium oxyphilum*, sp. nov. In cultivation, Washington, D. C.

Ait. The second (Fig. 2), taken in the writer's garden in mid-August, 1925, shows the long flexuous pedicels, the separation of the perianth segments into two groups, and even the dimorphism of the stamens, in that only three of these are in evidence in any one flower, the other set being still included in the corolla or withered away.

MAMMOLOGY.—*Localization of the cells of the descending visceral tract in the cat and guinea-pig (preliminary communication).* WILLIAM F. ALLEN, Department of Anatomy, University of Oregon Medical School, Portland, Oregon.

As a result of a study of several Nissl-stained brain stems of cats and guinea-pigs in which the spinal cords had been hemisected, it was found that practically all of the cells in the *nucleus commissuralis* and in the *nucleus tractus solitarii* were altered cells. That is, these cells had undergone Nissl degeneration or chromatolysis. Many of these cells were in an advanced stage of degeneration, exhibiting considerable vacuolation and disintegration. It is of interest to record that no altered cells are present in the cephalic and middle portions of the *nucleus tractus solitarii*, an area which was described in a previous paper,[1] as showing chromatolytic cells after severing the *lemniscus medialis* of the opposite side in the mid-brain region. Furthermore, to note that the area portraying degenerate cells in the caudal part of the *nucleus tractus solitarii* and in the *nucleus commissuralis* in these experiments, is identical to the area that showed no chromatolytic cells in the previous work,[1] where the *lemniscus medialis* was severed. It is obvious that the degenerated cells in these experiments, belong to the *nucleus tractus solitarii* and the *nucleus commissuralis*, and not to some adjacent nucleus, for the reason that they were shown in a still earlier paper[2] to occupy identically the same sensory regions that were supplied by degenerated fibers from the *tractus solitarius*, brought about through severance of the sensory root fibers of the VII, IV, and X cranial nerves.

Since some experiments in which the hemisection of the spinal cord extended over to the opposite side, to include the ventral column of that side, demonstrated a degeneration of the cells of both commissural nuclei and the caudal ends of both solitary tract nuclei, it can be concluded that the descending fibers arising from these, nuclei on one side, cross to the opposite side as internal arcuate fibers, and descend with the ventral cortico-spinal fibers of the opposite side.

[1] Allen, W. F. *Origin and destination of the secondary visceral fibers in the guinea-pig.* Jour. Comp. Neur., 35: 275–311. 1923.

[2] Allen, W. F. *Origin and distribution of the tractus solitarius in the guinea pig.* Jour. Comp. Neur., 35: 171–204. 1923.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE BIOLOGICAL SOCIETY

679TH MEETING

The 679th meeting was held April 11, 1925, at 8:00 p.m. in the new assembly hall of the Cosmos Club, with President ROHWER in the chair and 73 persons present.

Miss KATHERINE STUART exhibited specimens of solitary bees which have been very abundant in Oxford, N. C., for two successive springs. They raise little red nest domes of clay and have ruined many lawns. The specimens have been identified by Mr. ROHWER as *Andrena* sp.

M. K. BRADY described the discovery of a nest of *Cryptotis parva* containing about 20 young.

Dr. A. E. IMMS, of Rothamsted Experiment Station, introduced by Dr. L. O. HOWARD, described the history of the Rothamsted Experiment Station. J. E. LAWES, who had discovered the value of superphosphate as a fertilizer and made considerable money from its exploitation, devoted the proceeds to study of agricultural problems. He was associated with the chemist HENRY GILBERT. The Station was established in 1843, and work was done in a barn. In 1854, with the aid of subscriptions, the first real laboratory was built. A new laboratory was built in 1919, and another since. The station is supported with the aid of a government grant, and is devoted to the study of soil science in the widest sense.

The speaker described his own work on the reproduction and migration of *Aphis rumicis*. The whole experimental stock was bred from one agamic female. It is found that many more young are produced with increased illumination. The broadbean is attacked much more than its supposed ancestor, *Vicia narbonensis*.

W. F. THOMPSON, introduced by LEWIS RADCLIFFE, spoke briefly on the treaty between Canada and the United States for the protection of the halibut.

Program: L. O. HOWARD, *Something about estimates of loss through insect damage.*—The speaker discussed the past loss to agriculture due to the depredation of insects. Marlatt's estimate is that the damage done in 1919 was $2,200,000,000. The subject is a very complicated one. The difference in the value of the product raised, due to a raise in price caused by reduced quantity, is probably offset by secondary losses due to reduction in the amount of manufacturing, as in milling, cotton manufacturing, etc. The loss from diseased insects, stored product insects, and insects feeding on cloths is vast but extremely difficult to estimate in figures. The loss from the cotton boll weevil has been estimated at $524,000,000 in one year. Very much damage is also done by post and powder beetles. In conclusion the speaker showed a moving picture illustrating some of the principal insects damaging wood and their work.

VERNON BAILEY, *Making pets of insect-eating bats.*—The speaker exhibited a large brown bat which has been kept as a pet in his house for over a month. It makes its home under an Indian basket on the wall and flies about freely at night. It has learned to go to one place to be fed and watered, drinks eagerly from a spoon or from drops on the finger tip, and eats a great variety of insects, as well as raw or cooked meat, fish, lobster and ice cream. It

refuses slugs, angleworms, ants, rough centipedes and one kind of soft beetle. Contrary to ordinary belief bats are exceptionally free from parasites, are harmless, cleanly, intelligent and very useful animals and do not get in ladies' hair. More interesting house pets would be hard to find.

680TH MEETING

The 680th meeting was held in the new assembly hall of the Cosmos Club April 25, 1925, at 8 p.m., with President ROHWER in the chair and 42 persons present. New members elected: WILLIAM P. HARRIS, JR., DOROTHY H. POPENOE, WILSON POPENOE (life member).

A. A. DOOLITTLE exhibited an ostrich egg from the Zoo which he had boiled and cross-sectioned. The yolk showed concentric lines. The weight of the egg was 51 oz. He also described a method of water-proofing labels for fluid specimens by infiltrating the labels with paraffin, used either melted or as a solution in xylol.

S. F. BLAKE described a curious family of cats seen in the city. The mother is black, with a slight white mark on the throat. Her two kittens are pure white, and in each the right eye is green and the left bright blue.

L. N. HOFFMANN reported the capture of a young specimen of *Clemmys muhlenbergii* near Stubblefield Falls, Virginia, which has been identified by Dr. L. STEJNEGER. It was kept through the summer, but lost sight of, and was later found dead in the yard. This is the first record for this species in the vicinity of Washington.

S. A. ROHWER reported since the last meeting, further lots of bees (*Andrena* sp.) had been received from northern Virginia and from New Jersey. In both localities the same habit of damaging lawns by nest building was reported.

Program: SMITH RILEY, *Forest fires and wild life.*—The speaker described the abundant animal and plant life of a large area in northern Idaho and western Montana. The effect of extensive forest fires in this area in the dry year 1910 was then discussed. Not only were large numbers of the larger game animals, such as elk, deer, and bear, destroyed, but innumerable small animals and birds. The heat was so intense that great numbers of fish were killed even in rapidly flowing mountain streams. The indirect damage to wild life, through destruction of cover and food supply, was far-reaching but impossible to measure accurately. The conditions described in this area are typical of the damage done by fires in the great forested regions of the western States.

WILSON POPENOE, *Peruvian agriculture of Pre-Columbian days* (Illustrated).—Among the civilized peoples of Pre-Colombian America, the Maya of Guatemala and Yucatan excelled in the development of a written language and of a highly intricate and exact calendar system; the Aztec of Mexico in the arts of warfare; and the Peruvians in agriculture, in weaving, and in social organization.

The agriculture of the ancient Peruvians was noteworthy in several respects. On the rocky slopes of the high Andes they built series upon series of stone terraces, filled them with rich alluvium from the fertile valleys below, and irrigated them artificially from the mountain streams above. They brought many wild food plants into domestication and through conscious or unconscious selection carried some of them to a high degree of agricultural perfection, and they understood the use of artificial fertilizers.

Their achievements are all the more remarkable when it is recalled that they were practically without metal implements; that they had no draft

animals worthy of the name; and that they never developed a written language with which to pass on the accumulated information of generations.

Other countries have profited greatly in modern times, through the introduction of some of the plants first domesticated by the ancient Peruvians. The potato is a food crop of major importance in Europe and North America, while the tomato and the peanut are extensively grown in many regions. (*Author's abstract.*)

S. F. BLAKE, *Recording Secretary.*

THE ENTOMOLOGICAL SOCIETY

370TH MEETING

The 370th meeting of the Entomological Society was held December 4, 1924, at the National Museum, with President BÖVING in the chair and 34 persons present.

Officers elected for 1925 were: *President*, R. A. CUSHMAN; *First vice-president*, J. M. ALDRICH; *Second vice-president*, J. A. HYSLOP; *Editor*, CARL HEINRICH; *Recording secretary*, C. T. GREENE; *Corresponding Secretary-Treasurer*, S. A. ROHWER; *Executive-Committee*; A. N. CAUDELL, W. R. WALTON, J. E. GRAF; *Vice-president of the* ACADEMY, S. A. ROHWER.

Program: WM. SCHAUS: *Mimicry and the Entomological Society of London.* The speaker read abstracts from the proceedings of the Society's meetings on the subject of mimicry. Many of the theories held by members of the society the speaker considered far-fetched. The so-called mimetic groups of butterflies, which vary according to distribution, all the species showing the same change under similar conditions, simply represent a development along parallel lines. Coloration is aggressive rather than protective. All these species are devoured, the Heterocera being especially attractive to birds.

R. C. SHANNON discussed mimicry in the Syrphidae. Dr. W. M. MANN spoke of mimicry among the army ants, calling attention to the numerous species of beetles which greatly resemble these ants, and live in their nests.

Notes and Discussion: M. C. LANE spoke of the study of wire worms in the State of Washington. Dr. MANN gave an account of this recent trip to Europe, in the course of which he visisted museums in Spain, Portugal, Paris, Genoa, Switzerland, Leiden, and England.

371ST MEETING

The 371st meeting was held January 8, 1925, at the National Museum, with President CUSHMAN in the chair and 46 persons present.

The Editor reported that the last volume of the Proceedings contained 56 articles, 54 of which were systematic papers, and 235 pages.

The following were elected to membership in the Society: HENRY GOOD, Alabama Polytechnic Institute; Miss GRACE H. GRISWOLD, Cornell University; DONALD T. RICE, Ithaca, New York.

Dr. A. G. BÖVING was elected to represent the Entomological Society as Vice-president of the Academy, in place of Mr. ROHWER, resigned.

Presidential Address by Dr. A. G. BÖVING: *A summer trip in Iceland southeast of Vatna-Jökul.* The paper was illustrated by several charts.

FRITZ JOHANSEN, Ottawa: The speaker dealt with the explorations and scientific work carried out by the Canadian Arctic expeditions of 1913–1918, under Stefansson. Sailing from Vancouver Island in 1913 the expedition separated into a northern and a southern party. The former, in the

"Karluk," was frozen into the ice north of Alaska, and carried over to northeast of Wrangle Island, where the ship went down in January 1914, and its company marooned, until the following summer.

The southern party wintered in Camden Bay, close to the boundary line between Alaska and Yukon, from September 1913 to July 1914; then sailed to new winter quarters in Dolphine and Union Straits, where it remained until July 1916, examining the copper-bearing rocks and studying the Eskimos, and the flora and fauna of this area.

The explorations of the new northern party in 1915–1917, the discovery of new islands north of the western part of the Canadian Arctic Archipelago, and Storkersen's eight months' drift with the ice north of Alaska in 1918, were all recounted.

The speaker emphasized the necessity for entomological collecting on the Alaskan Arctic Coast between Bering Strait and Point Barrow, in order to connect up the entomological work that has been done in southern Alaska with the detailed investigations made by this Canadian expedition, east of Point Barrow, where almost 100 new species and many biological data were obtained.

372D MEETING

The 372d meeting was held February 5th, 1925, at New National Museum with President CUSHMAN in the chair and 37 persons present.

Resolutions on the death of Colonel THOMAS L. CASEY were adopted.

AUSTIN H. CLARK was elected a member of the Society.

Program: R. E. SNODGRASS: *Senses, and the morphology of the sense organs of insects.*

The structure of the sense organs must be taken into consideration in any study of insect senses. A knowledge of the senses of insects is essential for general studies of insect tropisms and ecology; and extend research in those fields, by furnishing a better understanding of the nature of insects as living things, is most likely to lead to the development of new methods of control, as well as to a better appreciation of old methods of control of injurious species, and of the propagation of beneficial species.

The sense organs of insects were discussed under the heads of (1) hairlike organs, (2) campaniform organs, (3) plate organs, (4) the organ of Johnston, (5) chordotonal organs, (6) eyes.

This paper was discussed by Messrs. MCINDOO and ROHWER.

373D MEETING

The 373d meeting was held March 5, 1925, at the National Museum, with President CUSHMAN in the chair and 39 persons present.

The Secretary read a communication from the Russian Bureau of Information in Washington expressing the desire that more cordial and intimate relations be established between scientists in the United States and those in the Union of Soviet Republics. The Bureau offered to assist in the exchange of literature between scientists of the two countries.

Resolutions on the death of PAUL REVERE MYERS were adopted.

Program: *Entomological taxonomy* (in three parts): (1). From an economic aspect by A. C. BAKER; (2) from an educational aspect by E. D. BALL; (3) from a taxonomic aspect by S. A. ROHWER.

Dr. BALL stated that true taxonomy is an expression of the actual relationship of existing forms of life to each other. It is an interpretation of the path of evolution and as such is one of the most profoundly interesting and profitable fields of biological research. Evolution takes place in all

lines—in structure, function and habit. It is only when we consider all of the factors in their relations to each other that we arrive at a true concept of the path. If text-books of entomology were based on a truly evolutionary taxonomy it would be much easier for the student to obtain a ground work in the fundamentals of entomological science. In many cases the accuracy of taxonomic interpretations can be checked, as in the parallel evolution of the mammals and their external and internal parasites; also in the case of groups of insects and their internal parasites. The independent working out of these phylogenies has shown so close an agreement as to make it practically certain that they are accurate. This type of taxonomic studies is of the highest educational value, and should be a part of the life work of a much larger number of entomologists.

Notes and Discussion: Dr. J. M. ALDRICH announced that Colonel THOMAS L. CASEY had bequeathed his collection of beetles and his extensive library on the order to the National Museum. This is the largest gift of insects ever received by the Museum, containing, as estimated, the types of more than five thousand species.

R. C. SHANNON spoke of the need of a name which would be applicable to all Arthropoda exclusive of the Crustacea. He said this need is particularly felt in Medical Entomology where there is frequent need to refer to all of the poisonous, bloodsucking, disease-carrying, and parasitic (on vertebrate hosts) Arthropods as a single group. In view of the fact that a common well-known name is highly desirable and especially one that would be correctly applicable to all of the members of the group, he wished to propose the use of the name *insect* for this purpose. The use of the name in this sense would be in keeping with the definition of the word and in its frequent popular application. If this were done the phylum Arthropoda would be accordingly divided into two subphyla, one the Crustacea and the other the Insecta. The true insects would then be called the *Insecta, sensu stricto*, or by the other name for the Insects, the Hexapoda.

Mr. HEINRICH objected to Mr. SHANNON's change of the definition of the word *insect*. He said that definition of words should be more precise, and urged adherence to the present definition of the word insect.

Mr. ROHWER said that a single common term to cover all of the animals usually treated by entomology was desirable; he thought that the use of the word *insect* could well be expanded so as to include all of them, and that for technical use entomologists might use the word *hexapod* instead of insect and the word *hexapoda* instead of the word "insecta."

The subject was further discussed by Messrs. HOWARD, HYSLOP, MANN, SCHAUS, and THONE.

Mr. ROHWER exhibited six lantern slides showing nests of three different species of social wasps. One of these was of *Vespa carolina*, the photograph of the nest being made from specimens from Orlando, Florida. He pointed out the similarity between the underground nest and the aerial nest of the bald-faced hornet. Another nest illustrated was that of *Polistes versicolor*, an ordinary polistine. The third nest was that of *Polistes goeldii*, which is composed of two parallel cells arranged so as to form a long whip-like nest, the dorsal part being dark brown in color, the ventral being white, thus giving the nest the appearance of a snake. For this reason the natives of South and Central America commonly call this nest the snake nest.

374TH MEETING

The 374th meeting was held April 2, 1925, at the New National Museum, with President CUSHMAN in the chair and 33 persons present.

Program: W. M. MANN: *An entomological journey across Lower California.*

Notes and Discussion: E. A. BACK gave an informal talk on *Some fabric pests.* He exhibited numerous specimens of fabrics, books, and a chair, all of which were badly damaged by insects.

R. C. SHANNON exhibited material of a species of botfly (*Cuterebra*) which infests the howling monkeys of tropical America. He also showed a piece of the hide of a howling monkey, collected by J. L. BAER in Darien, Panama, which is literally riddled by the bot larvae. A third exhibit consisted of two adult specimens of *Cuterebra* reared from the red howler of British Guiana. The primate host of this botfly is a very unusual one as *Cuterebra* is addicted to the use of rodents and opossums for hosts.

Dr. EWING exhibited a tree frog (*Hyla arenicolor*) from Southern California, which had several specimens of a new species of mites of *Trombicula.*

375TH MEETING

The 375th meeting was held at the National Museum May 7, 1925, with President CUSHMAN in the chair and 42 persons present. Dr. CARL J. DRAKE was elected a member of the Society.

Program: L. O. HOWARD: *Notes on Albert Koebele.* An outline of the career of this distinguished entomologist, who died in December 1924, was given by the speaker.

E. R. SASSCER: *Inspection by the Federal Horticultural Board.*

Notes and Discussions: S. A. ROHWER reported the occurrence of European sawfly larvae boring in cherries in the United States. R. A. SHANNON exhibited a species of Microdon from Panama which possesses the unusual character of having the third antennal joint divided.[1] This species may prove to be the adult of the extraordinary larvae described recently from Panama by Professor WHEELER.

CHAS. T. GREENE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

On August 4, 1925, after a long illness, Professor JAY BACKUS WOODWORTH of the Department of Geology and Geography at Harvard University and a member of the ACADEMY, passed away in the sixty-first year of his age. He had been connected with the University since the year 1890. After serving as instructor in geology, he was promoted to an assistant professorship in 1901 and to an associate professorship in 1912. Many thousands of students have been introduced to the science of geology by Professor Woodworth. He served the University, not only as an enthusiastic and respected teacher but also as an administrator, serving on many committees and for some years as Chairman of the Department. Throughout most of his professional career he was a member of the United States Geological Survey and published many valuable memoirs under the auspices of that organization. Another of his leading contributions to science was a prolonged exploration in the geology of Brazil and other parts of South America. This expedition was financed by the Shaler Memorial fund, which is controlled by the Division of Geology at Harvard. It was appropriate that Professor Woodworth could have been the first investigator to be aided by this fund for he was the trusted friend of his master, Professor Nathaniel Shaler, who organized the present department of geology and geography at the University. As a labor of love, Professor Woodworth undertook the

[1] See this JOURNAL, 15: 211. 1925.

rather arduous task of organizing and continuously administering the Harvard Seismographic Station, which has been in continuous operation since the year 1908. Professor Woodworth was one of the American pioneers in the scientific study of earthquakes and the records from his station have been among those most prized by the seismological stations of the whole world. This is especially on account of the accurate timing of the records. It is important to note that Professor Woodworth steadily held the opinion that according to the testimony of both human history and the geological facts in hand, the city of Boston is not in serious danger from earthquake shocks. Like all other scientific students of New England earthquakes, he recognized that New England is sure to have small shocks at irregular intervals but he strongly deprecated the effort now being made in certain quarters to lead the public to the opinion that facts of science support the claim of considerable danger to Boston, and New England in general, from earthquakes. Professor Woodworth's other chief researches have been in the field of glacial geology, where he was the recognized authority; and in the structural geology of New England, particularly Massachusetts.

Professor Woodworth has served for some years on the National Research Council, his most important contribution to the work of that Council perhaps, being his service as Chairman of the Committee on the use of seismographs in war, 1917–18. He was active in the American Association for the Advancement of Science and in the administration of the Geological Society of America, of which he has long been a fellow. He was a member of the American Academy of Arts and Sciences; past president of the Seismological Society of America; a member of the Washington Academy of Sciences, of the American Geophysical Union, the Meteorological Society of America, Boston Society of Natural History, and other societies.

He is survived by a daughter, Miss Ethel Woodworth.

Professor Woodworth was born at Newfield, New York, the son of the Reverend Allen Beach Woodworth.

Dr. S. S. ADAMS received the honorary degree L.L.D. from Georgetown University at the annual commencement exercises this year.

Messrs. ARTHUR L. DAY and E. T. ALLEN of the Geophysical Laboratory, Carnegie Institution of Washington, are making a reconnaissance of the hot springs and geysers of the Yellowstone National Park.

E. F. BURCHARD of the U. S. Geological Survey has been granted four months leave of absence to examine iron ore deposits for the Argentine government.

C. WHITMAN CROSS and WILLIAM H. DALL, senior geologists, JOHN H. RENSHAW, well-known maker of artistic shaded relief maps for the Topographic Branch and GEORGE M. WOOD, veteran editor, all of the U. S. Geological Survey, were retired from active service on July 1 on account of age.